

# Psychological Statistics

## Measures of Central Tendency



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## What We Will Cover in This Section

- Introduction
- Statistical notation
- Mean
- Median
- Mode



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## Summation ( $\Sigma$ ), Part 1

- The Greek letter sigma ( $\Sigma$ ) means 'add up'.
  - $\Sigma x$  means add all of the scores for variable  $x$ .
  - $\Sigma y$  means add all of the scores for variable  $y$ .



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## Summation, Part 2

- $\Sigma x^2$  means add all of the  $x$  scores after squaring them.
- $(\Sigma x)^2$  means add all of the  $x$  scores first, then square them.
- $\Sigma(x - y)^2$  means subtract the  $y$  score from each  $x$  score then square the difference.

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## Example

$x$	$y$	$x^2$	$(x-y)$	$(x-y)^2$
2	4	4	-2	4
3	3	9	0	0
5	2	25	3	9
6	1	36	5	25
16	10	74	6	38
$\Sigma x$	$\Sigma y$	$\Sigma x^2$	$\Sigma(x - y)$	$\Sigma(x - y)^2$

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## Question

What number would you use to describe the typical height of people in this class?



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## Mean

- Sum the scores and divide by the number of scores.
- Symbols
  - Sample statistic:  $M$  or  $\bar{X}$
  - Population parameter:  $\mu$



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## Defining Formula

$$M(\text{or } \bar{X}) = \frac{\sum x}{N}$$



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What is the mean of this distribution?

1, 2, 3, 4, 5

$$\bar{X} = 3.00$$



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## Properties of the Mean

1. Algebraic center of the distribution.
2. Sensitive to each score in the distribution.
3. Sensitive to extreme scores.
4. Most stable measure, resists sampling fluctuation.
5. Used to estimate  $\mu$ .
6. Used in some form or other in almost all other statistical procedures.

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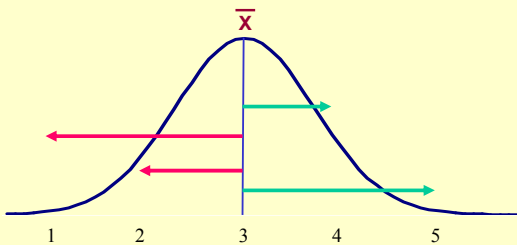
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## Algebraic Center



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## Strange Property of the Mean

$$\sum (X - \bar{X}) = 0$$

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## Demonstration: $\bar{X} = 7.5$

Score	$X - \bar{X}$
4	-3.5
5	-2.5
6	-1.5
7	-.5
8	.5
9	1.5
10	2.5
11	3.5
60	?

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## Assumptions

1. Measurement on interval or ratio scale.
2. Best used when the distribution is normal.

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## Median

- The score below which 50% of the scores fall.
- Represents  $P_{50}$ .
- Divides the distribution in half.
- Symbol.
  - Sample: Mdn

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## Example

8 9 10 11 12 13 14 15 16

8 9 10 11 12 13 16 16 46



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## Properties

1. Sensitive to the number of scores that fall above it and below it but not their values.
2. Relatively insensitive to extreme scores in skewed distributions.
3. Next best in resisting sampling fluctuations.
4. Best used when there are **skewed distributions**.
5. Not much use in higher level statistics.



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## Assumptions

1. Data are measured on an ordinal scale or higher.
2. The Median represents the 50<sup>th</sup> percentile ( $P_{50}$ ).



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## Mode

- The score that occurs **most frequently** in a distribution.
- Used for nominal scales or higher.
- Symbol.
  - Sample: Mo

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## Properties

1. Easy to compute.
2. OK for rough approximations of the 'typical' score.
3. Least stable score, highly sensitive to sampling error.
4. May be more than one mode.
5. Ignores much numerical information.
6. Little use beyond descriptive level.

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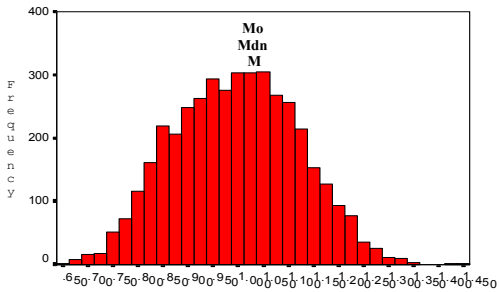
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Normal Distribution  
Leptokurtic



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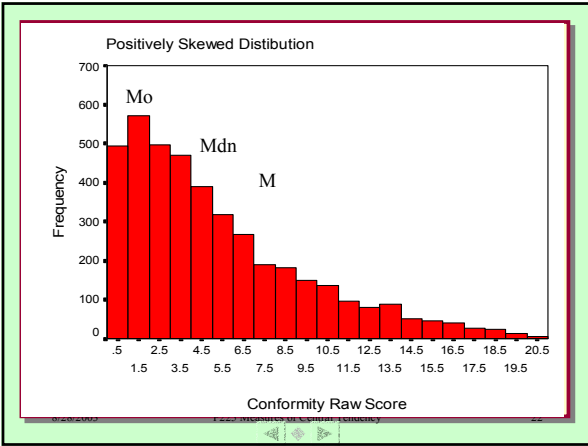
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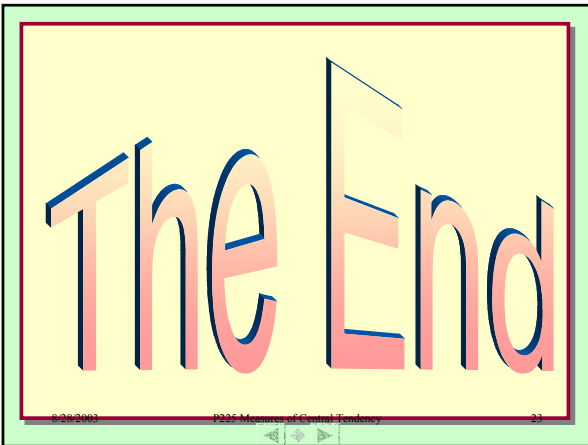
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